

# **EXHIBIT 14**

ENVIRONMENTAL JUSTICE  
 Volume 14, Number 2, 2021  
 Mary Ann Liebert, Inc.  
 DOI: 10.1089/env.2020.0052

# Tracing the Flow of Oil and Gas: A Spatial and Temporal Analysis of Environmental Justice in Coastal Louisiana from 1980 to 2010

Scott A. Hemmerling, Christine A. DeMyers, and Jessica Parfait

## ABSTRACT

Minority communities in Louisiana have long been at the forefront of the struggle to achieve environmental justice. To date, much of this struggle has focused on communities located in the Mississippi River Chemical Corridor, where rural African American communities have historically been disproportionately impacted by the growth of the petrochemical industry. This research examines the broader oil and gas production chain and shows that minority groups residing in Louisiana's coastal zone have been increasingly disproportionately impacted by the development of the offshore oil and gas industry. Extracting and processing oil and gas is an energy-intensive undertaking that requires an expansive network of land-based infrastructure. This infrastructure includes gas processing plants, refineries, petrochemical plants, and a pipeline network that link extraction activities to production activities. In addition, there is extensive infrastructure associated with oil and gas development that is not usually considered within the oil and gas production hierarchy, such as platform fabrication, ship building, and pipe coating. Due to the often-conflicting geographies of risk and settlement, these hazards are not equitably distributed across social groups. Using a combined risk and proximity-based hazardousness of place model to assess the cumulative impacts of these industries, this research found that oil and gas development from 1980 through 2010 has increasingly impacted the Native American and Asian populations in coastal Louisiana, groups that have historically been dependent on the region's abundant fisheries. This research also found that racial and ethnic minority groups are more likely to be disproportionately impacted than other socially vulnerable population groups.

**Keywords:** coastal Louisiana, environmental equity, outer continental shelf oil, onshore infrastructure, hazardousness of place

## INTRODUCTION

---

© Scott A. Hemmerling *et al.* 2021; Published by Mary Ann Liebert, Inc. This Open Access article is distributed under the terms of the Creative Commons License (<http://creativecommons.org/licenses/by/4.0/>), which permits unrestricted use, distribution, and reproduction in any medium, provided the original work is properly cited.

Dr. Scott A. Hemmerling is Director of Human Dimensions at The Water Institute of the Gulf in Baton Rouge, Louisiana, USA. Dr. Christine A. DeMyers is Anthropologist at The Water Institute of the Gulf in Baton Rouge, Louisiana, USA. Jessica Parfait is Anthropologist at The Water Institute of the Gulf in Baton Rouge, Louisiana, USA.

EXTRACTING AND PROCESSING offshore oil and gas is an energy-intensive undertaking that requires an expansive network of land-based infrastructure. This infrastructure includes gas processing plants, refineries, petrochemical plants, and a pipeline network that link extraction activities to production activities. In addition, there is extensive infrastructure associated with oil and gas development located offshore on the outer continental shelf (OCS) that is not usually considered within the oil and gas production hierarchy. Industries such as platform fabrication, ship building, and pipe coating facilitate oil and gas exploration and downstream production activities.

## TRACING THE FLOW OF OIL AND GAS

135

Although the development and expansion of the oil and gas industry has fostered economic growth and provided employment opportunities for many coastal residents, there are also potential negatives associated with living and working in proximity to oil and gas infrastructure.<sup>1</sup> The oil and gas production process is often associated with physical and public safety hazards, in addition to air, water, noise, odor, and light pollutants.<sup>2</sup> Due to the often-conflicting geographies of risk and settlement, these hazards are likely not equitably distributed across social groups. Previous research indicates the potential for both participatory and distributive injustices in populations living near all phases of oil and gas development, from the wells<sup>3</sup> through the refineries.<sup>4</sup> In some cases, economic development and the growth of industry may exacerbate injustice, making some socially vulnerable groups more vulnerable than they were before this development.

This research assesses the spatiotemporal inequities and environmental justice concerns of upstream and downstream oil and gas operations in coastal Louisiana. In the oil and gas sector, the term “upstream” broadly refers to the searching for and production of crude oil and natural gas and includes those activities that occur before oil and gas production has started.<sup>5</sup> The upstream supply chain reaches its endpoint at the extraction site, be it an onshore well or an offshore drilling rig. Conversely, the downstream supply chain refers to those activities that occur after the extraction of product and includes the transportation and processing of crude oil and natural gas.<sup>6</sup> For many oil and gas operations in coastal Louisiana, the downstream supply chain reaches a terminus in the

Mississippi River Chemical Corridor, an 85-mile stretch of river home to more than 150 industrial and petrochemical facilities.

The Chemical Corridor has come to be emblematic of environmental justice concerns in Louisiana, with more than 80% of releases reported through the Toxic Release Inventory emanating from this stretch of the Mississippi River,<sup>7</sup> but it is far from the only such concern. The potential for adverse impacts exists at all points along the extensive petroleum supply chain spread throughout the Louisiana’s vast coastal and estuarine environments. Previous research conducted in coastal Louisiana for the U.S. Bureau of Ocean Energy Management (BOEM) revealed that minority residents of the wetland fringe, such as members of the United Houma Nation tribe, are far more likely to reside in proximity to oil and gas infrastructure.<sup>8</sup>

The inherent threat presented by industrial development in Louisiana’s coastal zone is often compounded by natural hazards and tropical weather events. Hurricanes Katrina and Rita, for example, destroyed 46 offshore platforms and damaged 20 others, in addition to damaging nearly 100 pipelines. These incidents resulted in more than 200 “minor” spills involving less than 500 barrels of oil, many of which directly affected small rural communities in the immediate vicinity of the spills. Other incidents at downstream facilities such as refineries have the potential to impact larger numbers of people. The largest release associated with Hurricane Katrina occurred at the Murphy Oil refinery, which spilled ~819,000 gallons of crude oil into a highly populated area of St. Bernard Parish after an above-ground storage tank was damaged as a result of storm surge and flooding associated with Hurricane Katrina.<sup>9</sup> The broad spatial scale of the oil and gas production chain presents a highly complex hazards surface with the potential to negatively impact human populations at several key points.

Environmental justice and social vulnerability are the two theoretical concepts that form the framework of this assessment. As defined by government agencies, environmental justice functions as an accounting system whereby agency personnel seek to identify minority and low-income

<sup>1</sup>Scott A. Hemmerling, Tim J.B. Carruthers, Ann C. Hijuelos, and Harris C. Bienn. “Double Exposure and Dynamic Vulnerability: Assessing Economic Well-Being, Ecological Change and the Development of the Oil and Gas Industry in Coastal Louisiana.” *Shore & Beach* 88 (2020): 11.

<sup>2</sup>John L. Adgate, Bernard D. Goldstein, and Lisa M. McKenzie. “Potential Public Health Hazards, Exposures and Health Effects from Unconventional Natural Gas Development.” *Environmental Science & Technology* 48 (Aug 2014): 8307–8320.

<sup>3</sup>Eliza D. Czolowski, Renee L. Santoro, Tanja Srebotnjak, and Seth B.C. Shonkoff. “Toward Consistent Methodology to Quantify Populations in Proximity to Oil and Gas Development: A National Spatial Analysis and Review.” *Environmental Health Perspectives* 125 (Aug 2017): 086004 ; Lisa M. McKenzie *et al.* “Population Size, Growth, and Environmental Justice Near Oil and Gas Wells in Colorado.” *Environmental Science & Technology* 50 (Nov 2016): 11471–80.

<sup>4</sup>Angela Carpenter and Marcus Wagner. “Environmental Justice in the Oil Refinery Industry: A Panel Analysis across United States Counties.” *Ecological Economics* 159 (2019): 101–109.

<sup>5</sup>Adrienne C. Kroepsch, Peter T. Maniloff, John L. Adgate, Lisa M. McKenzie, and Katherine L. Dickinson. “Environmental Justice in Unconventional Oil and Natural Gas Drilling and Production: A Critical Review and Research Agenda.” *Environmental Science & Technology* 53 (June 2019): 6601–6615.

<sup>6</sup>Stephan M. Wagner, Kamil J. Mizgier, and Philippe Arnez. “Disruptions in Tightly Coupled Supply Chain Networks: The Case of the US Offshore Oil Industry.” *Production Planning & Control* 25 (Apr 2014): 494–508.

<sup>7</sup>Barbara L. Allen. *Uneasy Alchemy: Citizens and Experts in Louisiana’s Chemical Corridor Disputes*. (Cambridge, MA: The MIT Press, 2003); Beverly Wright, “Race, Politics and Pollution: Environmental Justice in the Mississippi River Chemical Corridor,” in Julian Agyeman, Robert D. Bullard, and Bob Evans (eds) *Just Sustainabilities: Development in an Unequal World*. (London, United Kingdom: Earthscan Publications Ltd., 2003), 125–145.

<sup>8</sup>Scott A. Hemmerling and Craig E. Colten. *Environmental Justice Considerations in Lafourche Parish, Louisiana*. (New Orleans, LA: U.S. Dept. of the Interior, Minerals Management Service, Gulf of Mexico OCS Region, 2003); Scott A. Hemmerling and Craig E. Colten. *Environmental Justice: A Comparative Perspective in Louisiana*. (New Orleans, LA: U.S. Dept. of the Interior, Bureau of Ocean Energy Management, Gulf of Mexico OCS Region, 2017).

<sup>9</sup>John Pine. “Hurricane Katrina and Oil Spills: Impact on Coastal and Ocean Environments.” *Oceanography* 19 (2006): 37–39.

areas in the study. Note, however, that this represents an increase in risk from 2000, when the odds of exposure were 0.95, where a value of 1.00 represents the point at which the odds of residing in more hazardous or less hazardous areas of coastal Louisiana would be equal. Once again, the Native American population has the greatest odd of exposure, with a value of 1.70, followed by the Hispanic population at 1.21 and the Asian population at 1.16 times more likely to be exposed. While remaining significantly more likely to be exposed than not to oil- and gas-related hazards, the greatest fluctuations in odds of exposure has been with the Hispanic population, many of whom work in coastal Louisiana's shipbuilding and fabrication yards.<sup>43</sup> The odds of exposure for the Hispanic population declined from 1990 to 2000 and then increased between 2000 and 2010. The increased odds of exposure in 2010 is likely due to the influx of Hispanic workers who moved to Louisiana after Hurricane Katrina in 2005.

Other socially vulnerable groups have similar susceptibilities that could potentially impact their ability to respond to hazard events such as a lack of financial resources, special medical needs, and political disempowerment. At the coast-wide level, this research found that all socially vulnerable groups examined except for the elderly were disproportionately exposed at the time of the 1990 Census, though at levels significantly lower than those observed with race and ethnicity. By 2000, this situation had dramatically changed, with none of the socially vulnerable population groups found to be disproportionately impacted. This situation would become reversed again in 2010. After the shift to OCS production during the 2000s, the results from 2010 mirror those seen in 1990, with all socially vulnerable groups except for the elderly disproportionately exposed. In 2010, the most exposed areas in the state contain a preponderance of renter-occupied housing, which is 1.15 times more likely to be exposed to oil- and gas-related hazards.

## DISCUSSION

Previous research on the impacts of offshore oil and gas in coastal Louisiana found that geography and competition for limited space is a driving force behind many of the environmental inequities experienced today.<sup>44</sup> This current assessment builds off this earlier research and analyzes the historical development of these environmental inequities. Of all the decades explored in this study, the 1980s were found to have the most dispersed hazards surface. This decade represented a lynchpin in the history of oil and gas in Louisiana, after which deepwater drilling activity in the Gulf of Mexico spiked. This shift in focus to the OCS resulted in a restructuring of the state's industrial geography and a concen-

tration of new growth and hazards in the coastal zone. Before 1990, the dispersed hazards surface exposed a broader swath of the population to those hazards, although at lower overall levels.<sup>45</sup>

As offshore oil- and gas-related hazards became concentrated in the coastal zone, racial and ethnic minority groups with historical, cultural, and economic ties to the coast saw a spike in potential exposure. Asian, Hispanic, and Native American populations in coastal Louisiana have been exposed to more potential risk, resulting from oil and gas infrastructure development across all three periods of this study. Further, the Asian and Native American populations have shown a consistent upward trajectory in potential exposure to oil- and gas-related hazards from 1990 to 2010. This is highly indicative of a situation where coastal populations with a history of natural resource dependence are forced to compete with industry for limited land. Other socially vulnerable groups without such historical ties were not found to experience the same levels of exposure. This suggests a level of cohesiveness in resource-dependent and minority communities that is not present in some other socially vulnerable populations. For planners and decision makers tasked with assessing the social impacts of their actions, this represents an important point to acknowledge.

## CONCLUSIONS

Minority communities in Louisiana have long been at the forefront of the struggle to achieve environmental justice. Much of this struggle has focused on communities located in the Mississippi River Chemical Corridor where rural African American communities have historically been disproportionately impacted by the growth of the petrochemical industry. However, this research shows that many small coastal communities have been similarly impacted by the development of the offshore oil and gas industry. The majority of the development associated with offshore production has occurred along Louisiana's coastal fringe, from an increase in the number of shipbuilding facilities to the construction of new natural gas processing plants. The development of these industries from 1980 through 2010 has tended to disproportionately impact the state's minority populations who reside in small communities throughout Louisiana's coastal zone. This includes the state's Native American and Asian populations, groups that have historically been dependent on the region's abundant fisheries. These patterns are consistent with other research on coastal risks and hazards, which found a clear distinction between the exposure of urban and rural populations.<sup>46</sup>

<sup>43</sup>Hemmerling and Colten. *Environmental Justice: A Comparative Perspective in Louisiana*.

<sup>44</sup>Scott A. Hemmerling and Craig E. Colten. "Environmental Justice and the Spatial Distribution of Oil-Related Infrastructure in Lafourche Parish, Louisiana." *Southwestern Geographer* 8 (2004): 65–98.

<sup>45</sup>Hemmerling and Colten. *Environmental Justice: A Comparative Perspective in Louisiana*.

<sup>46</sup>Christopher Dalbom, Scott A. Hemmerling, and Joshua A. Lewis. *Community Resettlement Prospects in Southeast Louisiana: A Multidisciplinary Exploration of Legal, Cultural, and Demographic Aspects of Moving Individuals and Communities*. Issue Paper (New Orleans, LA: Tulane Institute on Water Resources Law & Policy, Sept 2014).

**TRACING THE FLOW OF OIL AND GAS**

145

When examined over time, distinct differences in rural exposure become apparent. Before expansion into the deep-water Gulf of Mexico in the 1990s, onshore and nearshore oil and gas development, though on the decline, were still dominant parts of the coastal hazardscape. As a result, inland residents were more likely to be exposed to the impacts of development. However, as production moved offshore, industrial growth and development similarly shifted closer to the Gulf of Mexico, bringing development into close contact with coastal resource-dependent communities. This research confirms that inland communities were more likely to be exposed to potential hazards in 1990 than they were in both 2000 and 2010. These results do not suggest that there has been a decrease in overall exposure for any groups throughout the study period. Rather, levels of relative exposure have shifted over time and these shifts have disproportionately impacted certain racial and ethnic minority groups more than others. Whether intentional or not, when socially vulnerable populations, racial or otherwise, are disproportionately impacted by environmental policies and decisions, this represents, by definition, an environmental injustice.

**AUTHOR DISCLOSURE STATEMENT**

No competing financial interests exist.

**FUNDING INFORMATION**

Funding by the United States Department of the Interior, Bureau of Ocean Energy Management under co-operative agreement number M16AC00022.

Address correspondence to:  
Scott A. Hemmerling  
Director of Human Dimensions  
The Water Institute of the Gulf  
1110 River Road S., Suite 232  
Baton Rouge, LA 70802  
USA

E-mail: shemmerling@thewaterinstitute.org